

Electronic Voting..

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Electronic Voting (E-Voting) in Indonesia: Reflection On E-Voting Practices in Some Countries

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Abstract— Recently, the term e-voting has often been discussed in Indonesia. This is due to the emergence of the discourse on the implementation of the e-voting system in the Indonesian Presidential Election which will be held in 2019. This e-voting option is used as an alternative solution because the hope of the election can be implemented at a cost that is more affordable, faster and practical. However, before giving support or rejecting the idea, it is better to conduct a study related to how the application of e-voting in several countries and what electronic systems are needed in the implementation of elections in Indonesia.

Keywords—election, electronic, e-voting, Indonesia, practices

I. INTRODUCTION

The idea of implementing e-voting in Indonesian elections has been concretely begun since 2009. This was marked by the granting of the judicial review conducted by the Jembrana Regent along with several hamlet heads in the area against Article 88 of Law No. 32 of 2004 concerning Regional Government. Through its decision number 147/PUU-VII/2009, the Constitutional Court then interpreted that the article stating "voting for the election of regional heads and deputy regional heads was carried out by voting for one of the candidate pairs in the ballot" can be done using the e- method voting, however, with the cumulative requirement to fulfill several conditions, namely: (i) not violating the principles of direct, public, free, confidential, honest, and fair, (ii) regions that apply the e-voting method are ready from the technology side, financing, human resources and software, the readiness of the community in the area concerned, as well as other necessary requirements. The Constitutional Court's decision began to be accommodated in article 85 of Law No. 1 Year 2015 juncto Law No. 10 of 2016 concerning the Election of Regional Heads stating that "voting for Elections can be done by voting through electronic voting equipment".

In general, most elections follow the principle of equality, or as it came to be known, the principle of "one person – one vote". However, this principle might pose difficulties for voters, who are not well informed regarding the particular matter that is voted on.[1] This is what makes the demand for the birth of a new system in elections, namely electronic voting. In order to address this issue, a

new form of voting has been proposed, namely electronic voting. The birth of the idea of e-voting in Indonesian elections is not without strong reason. This is partly due to the many challenges in organizing elections manually. From the lowest level, the voting place, counting process could take several hours and it is hard to determine whether the results are true or not. In each step of sending data to the next level could take several days [2]. Moreover, at the level of election organizers, there are many challenges faced both by General Election Commission (KPU) or the Election Supervisory Agency (Bawaslu). There are at least three challenges that can be identified. The first one is impartiality or neutrality. The second one is professionalism. The third one is the selection of election organizers [3].

Implementing e-voting is not only a matter of changing ballots into electronic voice mail but also about the validity and security of electronic transactions. Legal products, infrastructure, community readiness, the effectiveness of control mechanisms, and public awareness need to be studied first before we decide to use e-voting.

According to Fernandez, Red, Pelaez (2012) voting must satisfy the requirements below:

1. Privacy (anonymity)
There should be no way to link voters to their votes.
2. Eligibility Only
Eligible voters can vote and they must be registered before the election day. Eligibility is based on specific rules, predefined for each election.
3. Authenticity
The voters must be able to prove their identity.
4. Uniqueness:
Only one vote per voter should be counted.
5. No receipts
Voters cannot prove to a third party how they voted. This prevents some forms of vote selling or voter coercion.
6. Integrity
Votes should not be modified, deleted, or forged.
7. Accuracy
All valid cast votes are counted correctly
8. Verifiability and Auditability

It should be possible to verify that all votes have been counted and there should be a way to audit the election in case of complaints.

9. Traceability
Every voter should receive a proof that his vote has been counted correctly. This could be a paper trail that cannot be kept by the voter.
10. Certifiability. [4]
The whole election process, including the hardware and software used, should be certifiable according to predefined criteria.
Other requirements are for convenience, feasibility, or to allow more people to vote:
 1. Voter convenience:
The voters should have convenient access to the voting process and should be able to vote in a reasonable time.
 2. Usability
The ballot should indicate clearly the choices to be made and how to select them.
 3. Cost-effectiveness
The election structure should have a reasonable cost on equipment and access to allow everybody to participate and to allow even poor places to have elections.
 4. Flexibility:
The system should allow a variety of question formats, including open-ended questions. In some elections, elections of people are combined with the approval of propositions or even polling.
 5. Mobility:
There should be no restrictions on the locations from where a voter can vote.[4]
There are many different types of voting systems. Among them the most general types of them are:
 1. Systems Paper-based Voting Systems (PVS): record, count, and produce a tabulation of the vote count from votes that are cast on paper cards or sheets. Voters may be allowed by some PVSs to make selections by means of electronic input devices. Such input devices do not record, store or tabulate independently voter selections.
 2. Direct-recording Electronic (DRE) voting systems: record votes by means of a ballot display provided with mechanical or electronic optical components. A voter could activate these components. Such systems record voting data and ballot images in computer memory components. Also, data processing is achieved by the use of computer programs.
 3. Public network DRE voting systems (PNDRE): Make use of electronic ballots and transmit vote data from the polling stations to other locations over a public network. The votes may be transmitted as individual ballots as they are cast, or periodically as batches of ballots, or as one single batch, at the end of voting.
 4. Precinct count voting systems (PCVS): put the ballots in a tabular form at a particular place, say, a polling station. They provide mechanisms that store vote count electronically and transmit the results to a central location over public telecommunication networks.
 5. Central count voting systems (CCVS): Tabulate ballots from multiple precincts at a central location. Voted ballots are safely stored temporarily at the polling station. These ballots are then transported or transmitted to a central counting location. CCVS may, in some cases, produce printed reports on the vote count. The aim of this

paper is to develop an electronic voting system which can be used for university campus election and provides security and trusted properties. And then the system properties will be formally analyzed.[5]

Although such cases are common across organizations, failures of IT seldom come from the purely technical origin and they might, therefore, have only partly explained the lower level of success of information systems adoption. Many attempts, thus, have been made to incorporate organizational factors while introducing IT innovations e.g. organizational size, resources, knowledge barriers, project team competence, project plan [6].

II. RESEARCH METHODS

This paper is prepared through literature review method conducted by reviewing journals that discuss about e-voting. It also discusses various articles in preceding to get a more concrete picture of e-voting and its complex problems. Searching from journals and proceedings with the internet.

III. RESULTS AND DISCUSSION

A. E-Voting Practices in Several Countries

The electronic election system or known as e-voting is not new in the world. This system has been implemented in several countries such as Estonia, Netherlands, Brazil, the Philippines, India, The United State of America, Belgium and Ireland.

- Estonia
Since 2005, Estonia has had a total of eight e-enabled elections where eligible voters could cast binding ballots over the internet. Internet voting has been used for local, national and European elections. However, the number increased in each succeeding election, reaching 176,491 in the 2015 national elections. Using digital identification, voters can use their personal computers when connected to the internet and equipped with a smart card reader, to cast an electronic vote. E-voting is available during the advanced voting period via a website hosted by the Estonian National Electoral Committee (2005–2011).
E-voting itself involves three steps; first, the user opens the website and with their ID-card and first PIN-code to identify themselves, enters the system; second, after the system has verified the identity of the voter, it displays the list of candidates by party in the voter's respective district; third, by clicking on a candidate's name and then entering their second PIN-code, the voter casts their vote. The first five elections were reasonably similar for the user-end, with the only marked difference being the length of the period during which e-voting was available: three days in 2005 and 2007; and 7 days in 2009, 2011 and 2013. From 2009, e-voters needed to download a voting program instead of voting via the web-embedded application. In 2013, a vote verification feature was introduced to the e-voting system that allowed voters to verify—using a smartphone or tablet—whether their electronic vote was received as cast. Other than these differences, the eight e-enabled elections were reasonably similar, providing a valid point of comparison of the related dynamics in user behavior. On the technical side,

e-voting requires internet access and a minimum level of computer literacy, both of which are not universal in Estonia. However, the act of e-voting is no more difficult than other online activities, such as banking or shopping [7].

- Netherlands

Since 1994, the Dutch government has actively socialized the use of e-voting. The use of this technology is expected to make a positive contribution in the implementation of the General Election. The application of e-voting at the time, juxtaposed with the jargon of ease, time efficiency, speed of vote counting, and budget savings. In the 2004 elections, the Netherlands implemented an electoral system through the internet so that voters living abroad can participate online. In 2006, 90 percent of the electorate's votes were collected using an electronic system. In 2006, there was a campaign titled "*vertrouwen niet stemcomputers*" (we don't believe the electronic election system). At that time, the government began to pay attention to emerging issues. In just a matter of weeks, there is a paradigm shift in society's view of e-voting. The campaign that took place at the time, revealing so many security holes in the e-voting system that September 2007, the Election Advisory Commission published a critical report entitled "Voting with Confidence", which prompted the Secretary of State for Internal Affairs to revoke the Regulation for Approval of Voting Machine 1997. Then on October 1, 2007, the Amsterdam District Court finally revoked all the e-voting system certifications and returned to the manual electoral system in May 2008. The proposal for the development of a new e-voting system has since always been rejected [8].

- Brazil

E-Voting in Brazil for the first time in 1996 conducted in the State of Santa Catarina. Brazil was the first country in the world to conduct the biggest election on the planet using e-voting technologies. In 2002, more than 100 million voters cast their ballots on more than 406,000 touch-screen machines scattered all over the biggest country in South America [9].

- The Philippines

The Philippines is an ASEAN country that has implemented e-voting nationally since the elections six years ago. E-voting is in effect because the Philippines has a bad history in electoral fraud. In the 1986 Election, Ferdinand Marcos proved to be cheating so that starting in 2010, the Philippines adopted e-counting for three elections from 2010, 2013 and 2016. E-counting allows faster counting of votes than the manual method. In terms of voter participation, e-voting plays a major role in increasing community participation. The Electronic Election System in the Philippines succeeded in increasing voter participation from 74.99% in 2010 to 77.57% in 2013, and 81.62% in 2016. In terms of speed, increasing the speed of election results with the implementation of e-voting is very significant. In 2010, unofficial results of Presidential Election can be known 2 hours after the polling station closed. Whereas in the

2004 manual election system, the results of the presidential election were only known after 40 days. The speed of vote counting is able to reduce the number of conflicts caused by the election. After the 2010 elections, the Philippine police noted that Election-related incidents decreased by 50% compared to the 2004 elections and decreased by 65% compared to the 2007 elections. In addition to reaping praise for the speed and decline of the conflict, the Philippines also received criticism especially regarding system security, transparency issues, and technical constraints.

- India

In India first election using electronic voting is scheduled to hold from April 20 to May 10, 2004. India is the world's largest democracy with a population of more than 1 billion, India has an electorate of more than 668 million and covers 543 parliamentary constituencies, and will require more than one million electronic voting machines (EVMs). The legal approval in 1989 to allow the use of EVMs, they have been used in many state elections but never used an entire general election. Electronic Voting Machines prepared by Electronics Corp of India and Bharat Electronics. The EVM comprises two units, one for control by the polling staff and the other for the use of voters. The balloting unit requires voters to press the button next to the candidate's name and symbol and the control unit records the vote. A light next to the button glows, and a short beep sound follows indicating the vote has been cast. The polling officer then presses a switch to clear the machine for the next voter. The EVM comes in a reusable carry pack and can operate on a battery power source in remote areas. According to Election Commission officials, each EVM can record five votes minute or nearly 3,000 votes in a polling day [10].

- The United States of America

According to Aceproject data, in America, e-voting only covers one-third the number of voters. In the 2004 presidential election, there were failures at a number of polling stations. Voters cannot verify whether the e-voting machine actually records the votes as they intended, and even election officials are not likely to recount. Then there was concern about the security of using e-voting machines. Even so, the issue of e-voting in America is not only on the machine. As reported by the Electronic Frontier Foundation (EFF), another problem is with its untrained HR. In addition, this institution, on its website, *eff.org*, said that technicians from e-voting machine vendors still have unsupervised access to e-voting equipment. According to Aceproject data, in America, e-voting only covers one-third the number of voters. In the 2004 presidential election, there were failures at a number of polling stations. Voters cannot verify whether the e-voting machine actually records the votes as they intended, and even election officials are not likely to recount. Then there was concern about the security of using e-voting machines. Many technologies have been applied to address this challenge, especially in the United States, but none has been wholly successful [11]. Even so, the issue of e-voting in America is not only on the machine. As reported by the Electronic Frontier

Foundation (EFF), another problem is with its untrained HR. In addition, this institution, on its website, eff.org, said that technicians from e-voting machine vendors still have unsupervised access to e-voting equipment. Kohno, Stubblefield, Rubin, and Wallach (2004) analyzed the voting machines used in the US election of 2001. They complained that the code was not well documented but did not ask for modeling and verification of the complete system [12].

- **Belgium**

In Belgium, Electronic voting was approved by law in 1994 and widely used in the 1999 and 2000 general and municipal elections. In the general elections of May 18, 2003, 3.2 million Belgian citizens were able to vote electronically. Belgium's apply a similar approach as Ireland's in that it does not modify the voting process, but rather replaces the ballot paper with a machine at the polling station, and then uses an electronic counting system to tally the results. In 2003, an audit report released by the Federal Public Service of the Interior approved the systems after a simulation based on around 1 million votes.

Some difficulties were recorded during the 2003 voting (May 18) in the Belgian communes where electronic polling booths were in use for the general elections, which renewed both federal assemblies of the country. Delays occurred in voting operations in some localities, causing some polling stations to have to remain open well after the official closure time of 3 p.m. Voters, therefore, had to wait for a long time to cast their vote in some areas. Most did wait, due to Belgium's compulsory voting system and fines for failing to do so, but it was reported that an estimated 10% of voters abstained from the ballot in certain areas [10].

- **Ireland**

The introduction of electronic voting is the biggest change to the Irish electoral system since the establishment of the state over 80 years ago. The idea was introduced by the Fianna Fail/PD government in 1999 with an Act to allow the use of actual ballot papers for research into voting methods. In 2000 a public tender was issued and it was won by the Power vote/Nedap/Groenendaal consortium. Later in 2001, an amendment to the Electoral Act was passed allowing the Minister to approve machines for electronic voting. Remarkably, no objective or legal criteria were set for the machines or the software.

The first enabling legislation was brought in as part of a broad, controversial bill. Debate on this bill was quillotined by the Government. Several members voiced their concerns about the system at the time. They were assured that the introduction of electronic voting would not go ahead without all-party consensus. The system was then used in three constituencies in June 2002 General Election. The Government said the trial was successful, but others - including the authors - have grave reservations. The formal reports from the Returning Officers indicate many faults occurred. The results were declared without any external audit of the votes. Without further consultation, either with the Opposition or with

the public, the Government decided in October 2002 to implement the system countrywide for the June 2004 local and European elections. In 2003 a series of reports were published questioning the integrity of the system and the process used to introduce it. A Parliamentary committee examined the matter, but on December 18th, 2003, the government parties applied the whip to close the debate just after the authors raised many technical questions. A publicity campaign was launched by the Government in February 2004 costing some 5 million Euro [13].

B. Opportunities and Challenges of e-Voting in Indonesia

The rush in issuing policies that affect the lives of many people should not occur. Including the haste in determining whether this nation will use electronic systems (e-voting) in the Presidential Election. For a safety-critical system with a very high level of risk such as e-voting, haste is destruction.

There is an argument that in order to improve the election system, we need to apply electronic voting devices (electronic voting machines, e-voting) or electronic vote counting machines (e-counting) at TPS. Some parties responded to this statement by stating that Indonesia was not ready to implement this complex technology in the upcoming 2019 Presidential Election. It must be realized that e-voting is not a "wand" that can improve the electoral system in Indonesia. Election issues that exist today can actually be overcome by improving the administrative system, tightening supervision, or strengthening the legal and regulatory basis; without having to involve technologies such as e-voting. The readiness of the national industry related to the procurement, supply and development of e-voting system in the Presidential Election should also be considered.

It should be understood that there are not many parties in the government, who have an adequate understanding of technology for elections. Then how the solution? Are we going to hand over the management to the private sector? Indonesia's electronic election system should not be left to private developers (technology consultants) for a variety of reasons. Failure to apply e-voting in Ireland and the Netherlands occurs because it mandates the development of e-voting systems to private parties. The development of e-voting systems by the private sector in Ireland and the Netherlands relates transparency and availability of public information, limits public involvement in the system development process, eliminates the system of control and evaluation, thus ultimately destroying public trust in the system, organizers and election results.

The e-voting system (if it will be implemented) needs to be tested first in terms of fairness, eligibility, privacy, receipt-freeness, coercion-resistance, and verifiability. The proposed e-voting system must avoid over-complexity, and its security encryption functions must be understood by the public.

Many things must be prepared carefully if the Indonesian government wants to implement e-voting. Authentication of the voter is the first requirement for conducting an election either for e-voting or for paper-based voting. High-level security in the authentication process is provided using the Domain Driven Design (DDD)

architecture. The concept of DDD offered the voters' National Identification (NID) number, mobile number, and biometric serial number are verified during the authentication process. The implementation of the voting website is done using the Active Server Page (ASP.NET). The ASP page is then connected to the Microsoft SQL Server database. The ASP page is served from an Internet Information Services (IIS) server [14].

An e-voting system needs to be as simple as possible. Designers must avoid using algorithms that are too difficult and base their designs on simple system architecture. The more complicated a system is, the harder it is to be tested and assessed, which in turn reduces the level of public trust. This applies also to encryption functions. In fact, if indeed the use of complex encryption algorithms cannot be avoided, these functions must be published so that the public knows.

Treating an e-voting system like commercial software or vice versa, like a secret project, certainly won't make people believe. One fundamental aspect that makes Indonesians believe in the election process manually is their ability to see and understand the process and results of elections at the polling station level. E-voting and e-counting are complex technologies that may be difficult to use and understand, making it difficult to gain public trust. With the proliferation of news about hacking and manipulation of computer systems, the technology of collecting or counting votes does not build trust and has the potential to increase suspicion. Machine manipulation used in e-voting and e-counting, or the emergence of the perception that the tool is manipulated, can destroy the results of future elections and affect political stability in Indonesia.

Questions that may arise in a society with the enactment of e-voting or e-counting are:

1. The extent to which e-voting is vulnerable to hacker attacks?
2. Does e-voting not make it difficult for voters with special needs/disabilities?
3. Does e-voting provide an opportunity for voters to verify the results?
4. Is it true that the manufacturing of e-voting machines is not tied to certain political parties or political elites from certain political parties?
5. Can e-voting secure voters' votes?
6. Is there any guarantee that e-voting machines cannot be programmed to change the election results?

On the other hand, there are several factors that must be considered for policymakers and other key stakeholders working with Electoral Authority involved in the adoption of the e-voting technology:

1. Any e-voting solution should be considered as part of the ensemble of important elements for organizing successful elections.
2. The Electoral responsible for driving authority the use of e-voting technology must have the capacity to effectively support the use of e-voting solutions not only at major election centers but also at remote and rural locations.
3. Communication with stakeholders and among the various institutions (both government and non-governmental) involved in the adoption and use of the e-voting solution must be carefully planned and executed.

4. While it is clear that training will be required for all personnel involved in the adoption and use of new e-voting solutions, emphasis must be put on the efficacy of the training programs.
5. Given that most e-voting innovations involve relationships with technology vendors, adequate time must be given for localization and customization to fit the reality of the adopting environment.[13]

One of the conditions for e-voting is that there is a good and accurate list of voters. Voter data must also be available digitally so that it is easily accessible. Therefore, the governance of e-voting must pay attention to the registration process to validation and evidence that is owned by prospective voters. In the national context, there is still a chaos of voter lists encountered in the 2014 elections as stated by the Chairperson of Bawaslu (m.news.viva.co.id, December 3, 2013) and there are still problems with e-KTP (nasinal.kompas.com, 6 November 2014) shows that the issue of data voters needs to get attention first so that e-voting can be adopted properly.

IV. CONCLUSIONS

The assumption that the implementation of e-voting or e-counting in the General Election makes our country appear more advanced is a misguided assumption. We should learn from the experiences and failures of other countries. Only a few democratic countries in the world are still implementing these tools (e-voting and e-counting). Meanwhile, most countries have returned to the use of paper ballots and manual counting. The main reason is to prevent manipulation and still lack of public understanding or trust.

In recent discussions, the term e-recapitulation (e-recap) is also popular. E-recap is a system in which the computation, delivery and delivery of official election results will be safe, accurately, transparently and quickly computerized. Credible official results can be generated several days after the election, as in other countries whose democracy is advanced.

Election issues in Indonesia today are the length of the recapitulation process which takes up to two weeks. Whereas in other countries, the process of recapitulation is not up to a week. Even some can be finished in a matter of days. This long process, potentially causing inflection and buying and selling of votes conducted by unscrupulous officers recapitulation.

So, we should not be quickly consumed by e-voting or e-counting claims that are faster, better, and less expensive. Utilization of technology in elections should not be done in haste, full of ambition, let alone just follow-up. Adoption of a technology or electronic system must be tailored to the needs of the community.

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